BREAKOUT SESSION: ASP SCIENCE TOPIC
AEROSOL-CLOUD INTERACTIONS

1. *What are the most significant or important science questions that should drive ASP research in the next 5-10 years? What specific knowledge gaps must be filled?* Wed. Groups
2. *What approaches are required by ASP science in the next five years to make the needed scientific advances?*
3. *How can ASP be more effective in improving parameterizations or representations of priority aerosol processes in global climate models?*
4. *(If applicable to topic) how can ASP and ARM Science coordinate efforts to address this area?*

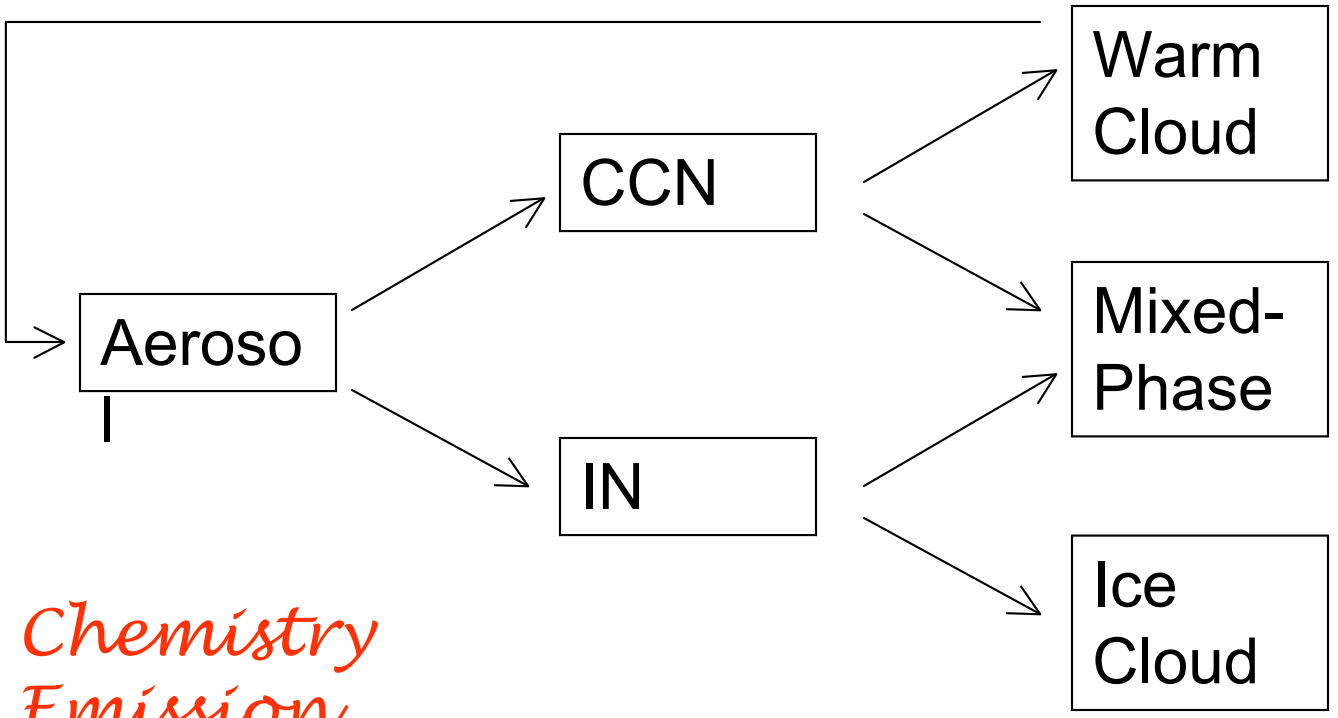
Thurs. Groups

- ASP needs strategy and concerted effort to optimize our output, especially in regards to cloud-aerosol interactions and partnership with the climate modeling community

REPORTS FORM WEDNESDAY BREAKOUTS
SCIENCE QUESTIONS/KNOWLEDGE GAPS

- What do we need to know to quantify the impact of aerosols on climate;
- Separate natural vs anthropogenic
    - Relative importance of nucleation/new particle formation vs primary emissions for CCN
    - Role of organics, nitrogen and non-sulfuric acid in new particle formation
    - What types of materials make the best ice nuclei?
    - How *little* do we have to know for models?

Aerosol cloud interaction roadmap



Approaches to make needed scientific advances Aerosol to CCN

- Size is important but so are composition and mixing state.
- Much progress on understanding CCN – especially for inorganic salts – still issues with organics, dust.
- ASP can apply its skills to in process level understanding of the microphysics and chemistry governing conversion of aerosol particles to CCN (e.g., the mechanisms for particle growth, such as SOA conversion of particles from Aiken to accumulation mode).
- Need to quantify the relative importance of nucleation/new particle formation versus primary particle emissions as sources of particle number for CCN.

Approaches to make needed scientific advances Aerosol to IN

- What do we need to know about Ice Nuclei? What materials make the best IN?
- Laboratory studies needed to answer these questions at the fundamental level. Also there is a gap in instrumentation for separating liquid water and ice in mixed phase clouds and remaining issues with particle sampling.
- IN less well understood, impacting our understanding of mixed phase clouds. IN activation mechanisms also impact cirrus cloud (when IN below a certain level cirrus might not form at all)

Improving parameterizations and process representation in climate models

- How little do we have to know for models: Minimum information for calculation of CCN properties, representation of turbulence, entrainment mixing.
- Need measurements in different (representative) environments. Reduce complexity in classes. How many classes of aerosol do we need for GCM.
- ASP needs to continue its process studies and interact with modelers to translate improved understanding into physically-based parameterizations.
- Need coordination with modelers to test parameterizations, to aid process analysis of field data, and to address larger questions like the attribution of forcing to anthropogenic verses natural sources.

Coordination of ASP and ARM science

- Joint field studies of mixed-phase clouds extending ASP expertise on in-situ measurements in warm clouds. Combine in-situ measurements with remote sensing technology, including new ARM 3D cloud structure. Joint studies with mobile facility. Need ARM remote sensing (cloud radar, lidar, satellite) measurements to give context to the ASP in-situ measurements.
- ASP instrument development. Fast sampling measurements: chemistry-aerosols – CCN spectrometer for aircraft – CAPS probe – in-situ measurements including of turbulence, single particle MS for particle size and composition. Combine with ARM remote sensing (radar and satellite).
- Collaborating with ARM on long term measurements. Need to bring in aerosols – ARM may miss a big component of aerosol composition. (both fixed site and mobility facility are needed for surface measurement).